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A Proposal for an EUV light source using transverse flow CO_2 lasers

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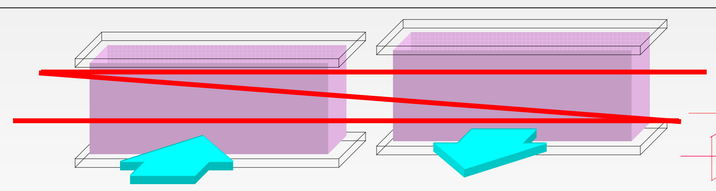
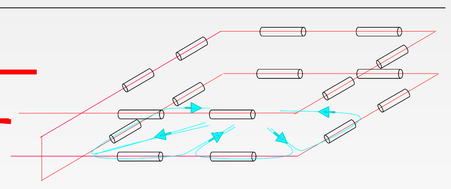
We carried out a basic design of a 40-kW pulse CO_2 laser system for EUV light source using transverse flow amplifiers based on a preliminary experiment. The authors conclude that the transverse flow CO_2 laser is a promising candidate for an amplifier in the laser-produced-plasma (LPP) EUV light source.

Efficient, stable laser

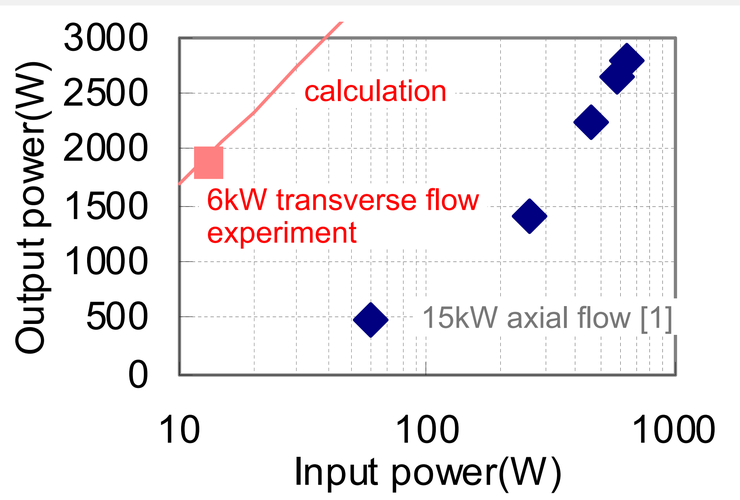
- Transverse flow CO_2 laser is suitable for amplifiers because:
  - Wider laser gas flow channels excellent in cooling enable to use lower pressure gas, accordingly produce a higher gain in principle compared with axial flow.
  - Transverse flow laser offers simple optical configurations.

	Transverse flow	Axial flow
	 Optical path ⊥ Gas flow	 Optical path || Gas flow
Gas flow cross-section	~1000 cm^2	~100 cm^2
Gas pressure	~7 kPa	~20 kPa
Gain	High	Low
Multi-pass	Possible	Impractical
Number of mirrors	Small	Large
Optical path	Short	Long

Efficient

Stable

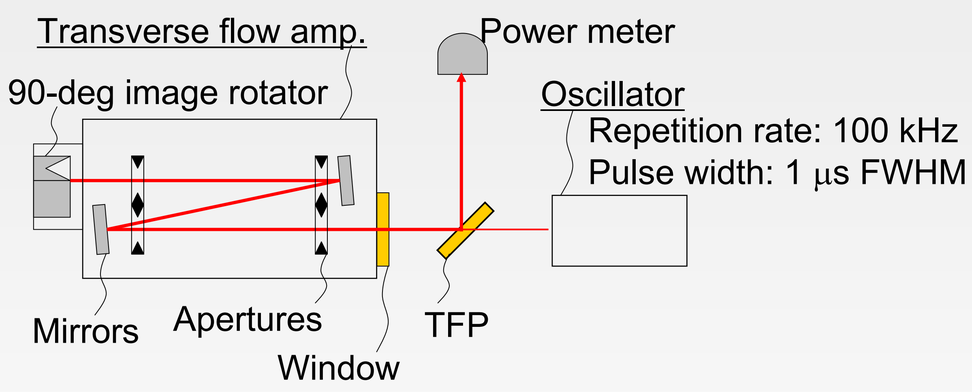
- Output power versus input laser power

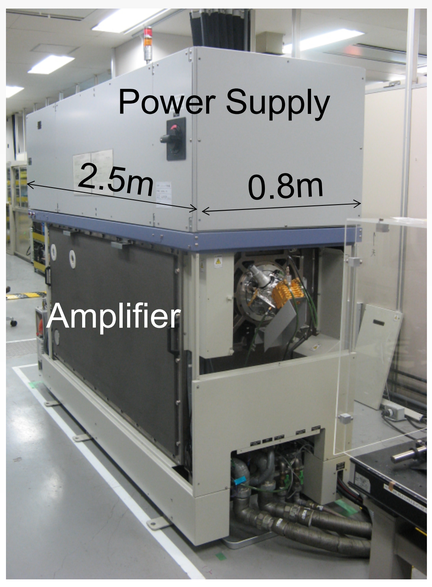


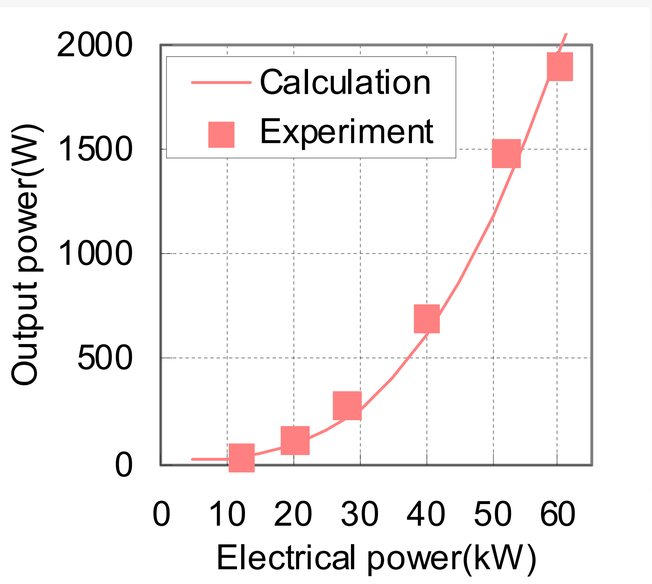
[1] H. Hoshino *et al.*, Proc. SPIE **6921**, 692131 (2008).

Preliminary experiment: transverse flow amp.

- A commercial 6-kW transverse flow CO_2 laser was used.
- We carried out an amplification test at a 100% duty cycle of pumping discharge.
- The measured output power was 1.9 kW with the optical input power of 13 W.

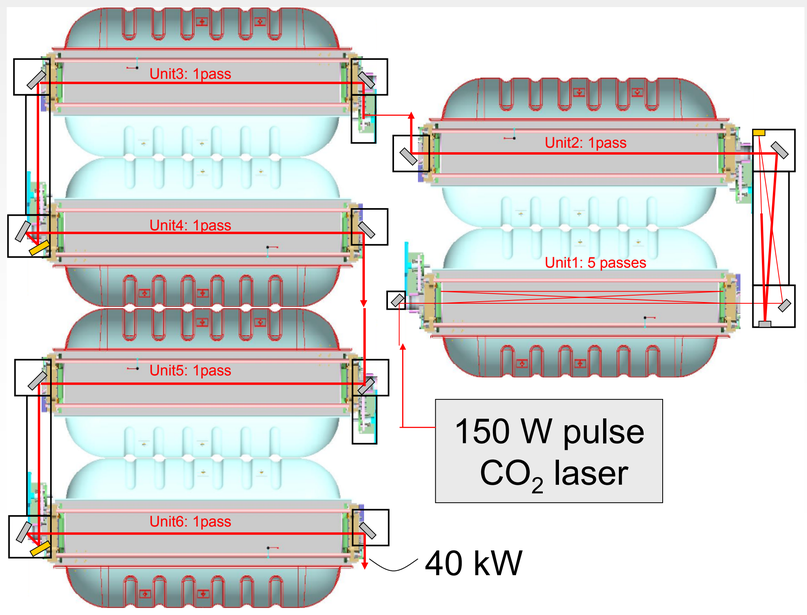






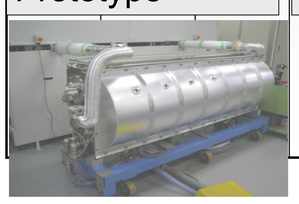
Basic design of 40 kW pulse CO_2 laser

- The basic design of the system using transverse flow amplifiers was based on the preliminary experiment.
- We are going to use six amplifier units to achieve 40 kW.
- The electrical discharge power for each unit is 100 kW.



Roadmap

2011		2012				2013			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1st amp unit Design & Prototype			4 units (25-kW) Prototype & Test				6 units (40-kW) Prototype & Test		



Acknowledgements:
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